WESTERN NATURE STUDIES

By J. H. PAUL.

THE STORIES TOLD BY THE WINTER BUDS.

While the earth is still snow-covered or just before the swelling of the buds in spring, it is a pleasant exercise to make an examination of the bare branches of the trees. The twigs of the common trees such as those of the apple, pear, peach, catalpa, poplar, cottonwood, maple, elm, willow, box-elder, and especially the wild oak-brush, squawberry and birch, are well adapted to winter study. Winter buds have an interesting story to tell. Cut one open, or watch its expansion in the spring, as it bursts into leaf or flower, and it will be seen that buds are dormant growing joints made ready last summer for the activity of spring. Buds are found on all the woody stems of trees in temperate latitudes, but those of the tropics are said to lack true buds, since the trees there never stop growing. On the ends of the growing shoots of tropical trees, however, a formation resembling a bud, but consisting of only a rolled or folded leaf, may be found. The buds of our winter twigs are always enclosed, for the sake of protection, in a definite membrane.

Trees in Winter.

With practice we can distinguish the various species of plants as well in their winter bareness as in their summer dress of foliage, flowers and fruit.

Each tree looks different from all other kinds as to color and texture of bark, mode of branching, stem-scars left by previous leaves and fruit, size, shape and arrangement of buds, and in other points plainly visible.

If the observer will go out among his fruit and shade trees just now, he will be able to read from their marks, their forms and their preparations for this season's work what is, in many respects, a rather fascinating and marvelous bit of history. He can soon learn to read the tree itself.

But he needs a guide. We learn from each other. All eyes do not see the same things, nor do all minds discover the same truths. If, therefore, teachers, using these hints as suggestions, will show to their students the winter twigs and tell them what to look for, the sharp eyes and keen senses of youth will quickly discover all that the teacher directs them to see.

Observation of Buds.

In the hardwood plants of our temperate zone, the buds in winter are always more or less inclosed in a scaly covering. This winter overcoat is for the protection of the bud from the rain and snow, and from the ice which would destroy them if the moisture should succeed in getting within these scales.

Though all of our buds have this form of covering, no two kinds are alike. The individuality of the tree manifests itself with peculiar emphasis in the buds. Each species has buds different from those of every other, and the various shapes, sizes, colors, coverings and arrangement on the stems offer many contrasts.

Leaf buds are always placed immediately above a little rough or bare spot called a leaf-scar. Not every individual bud has its leaf scar, for in some cases several buds are superposed above one another, and here one leaf scar subtends the whole group. Thus every leaf-scar has its bud, but not every bud its leaf-scar. Very small spots called dormant buds may be seen occupying the position of buds on the stem growth of previous years. Dormant buds, however, do not grow unless the regular buds fail to develop, as from drouth or injury. They are held in reserve, and may come forth as branches or fruit spurs, years after their formation.

Kinds of Buds.

At first we cannot foretell by looking at the bud whether it will produce a leaf or a flower. There is nothing in the earliest stages to indicate this. Neither is it known just what causes some buds to develop into flowers and others into leaves. The microscope before long and the naked eye finally, can detect the difference, which always begins to be discernible in the autumn. Peaches, cherries, apples, pears and apricots begin to differentiate their buds in July; and plums, raspberries, strawberries and grapes show the difference about the middle of September.

Vegetative buds include the leaf and the thorn buds; these usually show distinct leaf scars below them; while floral buds—those that develop into flowers—may be without scars, new buds often arising from below them. Buds that arise in unexpected places are called adventitious, and those in their usual positions, preventitious buds.

If we examine the winter buds of the American elm, we shall find low down on the branch, plump, round buds, which will produce flowers, while the smaller vegetative (leaf) buds are at the tops of the branches. The small buds will produce only leaves or branches; the large ones, flowers and perhaps fruits.

Arrangement on the Stem.

The relation of the buds to the twigs is shown by their position on the stem. In the case of the American elm, the buds are scattered in a spiral along the stem, while a glance at the box-elder will show that the buds are two at each node, but the nodes themselves are alternate, so that the arrangement is called opposite-alternate.

In the cottonwood the bud arrangement is a spiral, which may be shown by pinning one end of a string to one of the lower buds and passing it higher from bud to bud. By doing this, we find that we pass over five buds before coming to a bud that is exactly above the one from which we started.

Look at the buds of the lilac or of the soft maple. They are in pairs, one bud exactly opposite the other; but the pairs alternate in position as we go up or down the stem; that is, if the first pair stands east and west, the next pair will extend north and south, and the third pair east and west again, being perpendicularly above the first pair in a vertical shoot. In some trees, however, the opposite leaves are exactly over each other, making two rows up and down the stem. The opposite-alternate arrangement first mentioned makes four rows.

The Leaf Cycles.

In most shoots, the buds are alternate. The elm, for example, has its third bud directly above the first, with the second bud half way between them. Each bud is half way—180 degrees—around the circle, being placed as far as possible from any other bud. Such buds are said to be two ranked; their arrangement may be indicated by the fraction ½, the numerator (1) shows how many times we go around the stem in order to arrive at the bud directly above the one from which we begin, and the denominator (2) shows the number of buds we pass in so doing, since we pass the first but not the third.

In the plum the buds are alternate, but not half way around; here it is the sixth bud that is exactly over the first, and we pass twice around the stem from bud to bud to come to the sixth. Thus the angular distance between the buds is two-fifths of the circumference.

In this fraction, 2-5, the denominator (5) indicates the number of buds we pass, the numerator (2) the number of times we encircle the branch, in order to come to a bud directly above the one from which we started. In the alders, birches and sedges the fourth leaf or bud is normally over the first, the corresponding fraction being 1-3.

House leeks and pine cone scales are arranged in the forms of 5-13 and 8-21, the series from the first being derived by adding together the denominators and the numerators of the two preceding (next smaller) fractions. The whole series is thus 1-2, 1-3, 2-5, 3-8 and 8-21—a most interesting and simple method that nature has of arranging the leaf cycles of vegetation.

The Fruit Spur.

The fruit buds of the apple tree are borne mostly at the tips of short branches called fruit spurs. Occasionally, however, a fruit bud is borne at the top of the main branch. The fruit or flower bud is larger than the leaf bud; it seems to form wherever the growth of the stem which it terminates is checked, but if the stem is still further "starved" only a weak leaf bud will be produced. Wherever the bud appears, it stops the growth of the steam, and there arises from beneath or almost beside it a lateral bud, which will continue the growth of the spur next year. Yet, since the apple just above it will require much food, it will fail to get enough nourishment to grow into a flower bud, and will become a leaf bud. This alternation of fruit-bearing and non-fruit-bearing buds in the spur of the apple tree is the usual occurrence.

In the plum tree most of the buds and side spurs are at the ends of the growths, and the buds are in twos or threes rather than single. The plum spur is straight, because the terminal buds are leaf buds, and so the growth is not stopped by a terminal fruit as in the apple. Some of the side buds here are fruit buds, but it is difficult to distinguish them.

The Fruit Scar.

The scars left by fruits that fully developed during the previous season are large and round, and are often projected on short arms as in the peach tree. The fruit scar is not usually below but above the new bud that is to form another branch. It is nearly always at the end of a short, stubby spur.

Notice an apple tree. Below the fruit scar is a ring showing where the bud scales of last season dropped off, and another thicker ring with projections that show where flowers dropped off without forming fruit last year, and so leaving only small round scars. These thickened rings on the twig reveal its age, since one forms every year. The number of rings from which the bud scales and leaves have dropped, show the years of growth. These scars may be narrow grooves, nearly encircling the stem, or broader than the large leaf scars, from the leaves that grow from between the bud scales.

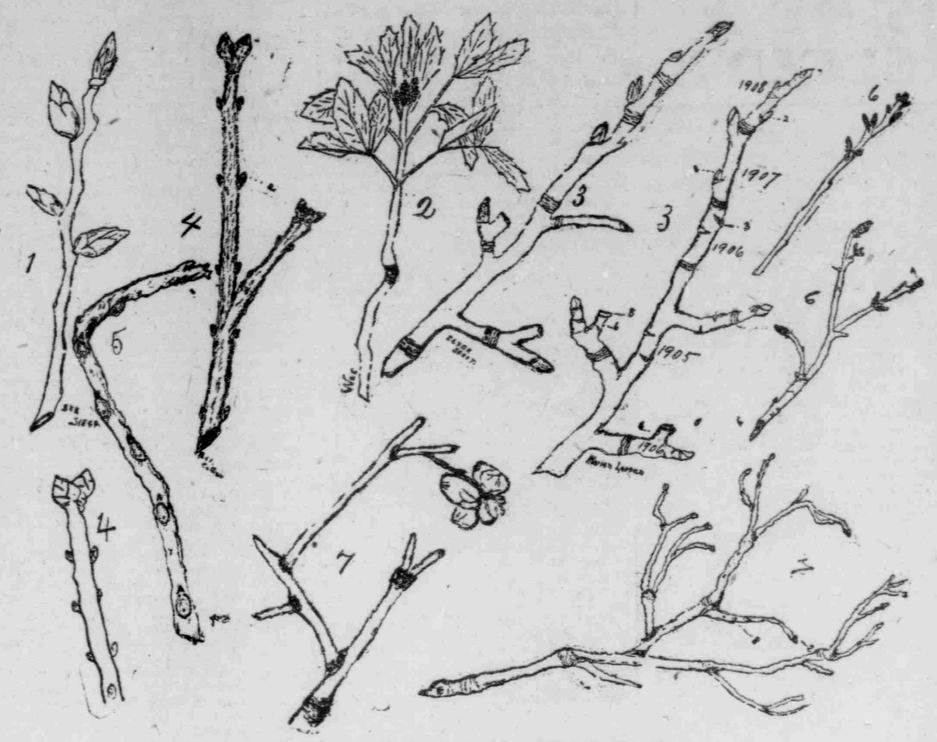
Bud Rings Show Age of Tree.

To tell the age of any small tree, begin at the top and count downward the number of these distinct rings. The marks near the ground become faint and are often undistinguishable. Those on the growing stems are usually plain and prominent. Notice the oak brush, the pear, and other familiar trees. An apple fruit branch only six inches long may be six years old. But on the leafy branches a year's growth is usually much greater. The short twigs occur along the sides of the smaller and lower branches. The short side twigs are usually the fruiting branches, or fruit spurs; the terminal bud is usually a strong leaf bud that will prolong the branch. But many of the smaller twigs of certain trees are tipped by flower buds and so grow up no further, but produce many side branches.

What to Observe on Winter Twigs.

We may now summarize the results of the observations—the things that may be learned from trees in winter.

1. The name of the tree from which the twig is taken.
2. The number, size, shape, color of the buds on it, and of the bud scales.
3. The different kinds of buds it contains—leaf, fruit, thorn, dormant.
4. Find the leaf scars of last year; note their shape and size, and the end marks of the woody vessels in them.
5. Count the number of buds at each leaf axil.
6. Why does only one of these usually develop?
7. Note the method of leaf casting—whether the old leaf breaks away clean-cut (articular)? or is still partly attached (non-articular)? (The non-articular mode prevails in endogens; the articular, in exogens).
8. Are the buds hairy, sticky, resinous, coated? or how protected from water?
9. Is the arrangement of the buds the ½, 1-3, 2-5 or ⅜ plan?
10. When do buds form?
11. What are knots?
12. What causes splits in the bark?
13. What is the age of the fruit spurs?
14. In what year did each begin to grow?
15. Which of the fruit scars produced mature fruit?
16. Find the holes or spots in the surface of the leaf scars, and explain the use of these woody bundles.
17. Find the spots that indicate the breathing pores (lenticels) in the bark.
18. How can you distinguish the leaf scar from the fruit scar?
19. What is the age of the twig? (Count the rough joint-like rings.)
20. Where is every bud found? (In leaf axil, above scar.)
21. Why are the buds of two sizes? (leaf and flower).
23. Where are the dormant buds? (Only on growths of previous years).
24. Which is the strongest or largest shoot? (The upper or outer, on account of receiving more light and air. Lie under oak brush and note the canopy formed by outer branches.)
25. Note the order of size of shoots—the largest above, the second largest next below, etc.
26. What happens in growth when the largest buds—the fruit buds—are at the end of the twig? (The axis of growth is deflected, since the growing shoot must then arise from below the fruit bud).
27. Cut across the twig and note the color, shape and size of the pith. ? (In trees with five-ranked buds the pith is more or less five-angled; in trees with opposite or alternate buds, it tends to be square. In the black walnut, the pith is diaphragmed—arranged in thin layers. The color, usually white, is dark-brown in the black walnut, pink in the Kentucky coffee bean and green in the Yahu.)
28. How many leaf scars occur at each leaf place? (In most trees, one or two; but the catalpa and others have three or more scars denoting a cluster of leaves called a whorl).
29. What is the exact shape of the leaf scar? (In the elm, illiptical; in the poplar, triangular; in the box elder, boat-shaped; in other cases circular, oval, oblong, etc.)
30. Will your trees bear fruit this season? (Observe whether or not vigorous flower buds are formed ready for opening).



The Story of the Buds, Illustrated by Pupils.

1. Lombardy poplars, showing the bud coverings.
2. Oregon grape, showing its winter leaves (evergreen) and the spike of flower buds making ready to open.
3. Twigs of the pear tree, showing fruit buds (1), leaf buds (2), leaf scars (3), age rings (4), fruit scar (5), and fruit spur (6). The dates show the growth of the last four years.
4. 4. Twig of the soft maple. The fruit buds are at the tips of the branches.
5. Twig of the Catalpa, showing the leaf scar (1), with the dots that mark the position of the vascular bundles and the fruit scar (2).
6. 6. Branches of the fragrant sumach (the skunkberry or Squawberry), showing the fruit buds in terminal spikes, the leaf buds lower on the stem.
7. 7. Branches of the oak brush, showing age rings, buds and some galls in one group, resembling a flower or fruit.

Drawn from nature for this article by seventh grade pupils of the State Normal Training school. This lesson given in the grade by Marian Larsen, normal student.